ISSN (print) 0093-4666 © 2012. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/119.405

Volume 119, pp. 405–411 *January–March 2012*

Marasmioid and gymnopoid fungi of the Republic of Korea. 5. *Marasmius* sect. *Hygrometrici*

Vladimír Antonín[1*], Rhim Ryoo[2], Kang-Hyeon Ka[2] & Hyeon-Dong Shin[3*]

[1] *Moravian Museum, Dept. of Botany, Zelný trh 6, CZ – 659 37 Brno, Czech Republic*

[2] *Korea Forest Research Institute, Department of Forest Resources Utilization, Seoul 130-712, Republic of Korea*

[3] *Korea University, Division of Environmental Science and Ecological Engineering, Seoul 136-701, Republic of Korea*

* Co-correspondence to: [1] *vantonin@mzm.cz* & [2] *hdshin@korea.ac.kr*

Abstract — Two species of *Marasmius* sect. *Hygrometrici* from South Korea are published in this paper. Descriptions based on morphological characteristics and illustrations are provided. *Marasmius crescentiae* is a new record for the studied region, and "*M. junipericola*" represents a provisional new species.

Key words — *Fungi*, *Agaricales*, *Marasmiaceae*, taxonomy, DNA studies

Introduction

This new paper in a series on marasmioid and gymnopoid fungi collected in the Republic of Korea (South Korea, Antonín et al. 2009, 2010a,b,c, 2011) covers species of sect. *Hygrometrici*. A provisional new taxon, "*Marasmius junipericola*" is described based on its very distinct macro- and microscopic characteristics. However, we do not formally publish a new name because there was too little material for molecular sampling. *Marasmius crescentiae* is recorded as new to Korea. We provide ITS and LSU sequences of three specimens of *M. crescentiae*.

Materials & methods

Macroscopic descriptions of collected specimens are based on fresh basidiocarps collected by the first author. Colour abbreviations follow Kornerup & Wanscher (1983), herbarium abbreviations are according to Holmgren & Holmgren (1998). Authors of fungal names are cited according to the International Plant Names Index Authors website (http://www.ipni.org/ipni/authorsearchpage.do). Microscopic features are described

from dried material mounted in H_2O, KOH, Melzer's reagent, and Congo Red using an Olympus BX-50 light microscope with a magnification of 1000×. Abbreviations: L = number of entire lamellae; l = number of lamellulae tiers between each pair of entire lamellae; E = quotient of length and width in any one basidiospore; Q = mean of basidiospore E-values. Specimens are preserved in the herbarium of the Moravian Museum, Brno, Czech Republic (BRNM).

DNA extraction, PCR amplification, DNA sequencing, and phylogeny tree construction methodologies followed Antonín et al. (2010a). New GenBank accession numbers are listed in Table 1. The Bayesian-based ITS phylogeny used the general time reversible (GTR) model with gamma-distributed substitution rates (Ronquist & Huelsenbeck 2003). Markov chains were run for 1,000,000 generations, saving one tree every 100th generation and discarding the first 1000 trees. This MCMC tree was used to compute a 50% majority rule consensus of the remaining trees to obtain estimates for the posterior probabilities (PPs) of the groups. The dataset includes *M. crescentiae* and *M. micraster* (both from sect. *Hygrometrici*), with the type species of *Marasmius, M. rotula*, selected as outgroup.

Table 1. *Marasmius* specimens sequenced for this study.

Species	Specimen ID	GenBank accession number	
		ITS	LSU
Marasmius crescentiae	BRNM 714783	FJ936141	FJ936147
	BRNM 714678	FJ936142	FJ936138
	BRNM 718790	JN003840	JN003845

Results

Marasmius crescentiae Murrill, North American Fl. 9: 259, 1915. Figs 1–2

Basidiocarps single. Pileus 3–5 mm broad, broadly conical to convex with slightly depressed centre and straight margin, sometimes with slightly depressed centre (when old) centre rugulose, sulcate otherwise, margin crenulate, surface tomentose, light brown to brown (± 6–7D–E6–7, 7E6), paler (brownish orange, ± 6B–C5–6) at margin. Lamellae distant, L = 9–15, l = 0(–1), shortly to broadly adnate, slightly intervenose when old, pale cream coloured, concolorous or with coloured (± pileus colour, especially in external part), pubescent edge. Stipe 20–65 mm long, filiform, insititious, smooth, glabrous, concolorous with lamellae at apex, (reddish) black-brown (8E–F7) otherwise.

Basidiospores 6.0–9.0 × 3.0–4.5 µm, average = 7.6 × 3.7 µm, E = 1.6–3.0, Q = 1.8–2.6, ellipsoid-fusoid, fusoid or sublacrimoid, thin-walled. Basidia 17–26 × 7.0–9.0 µm, 4-spored, (broadly) clavate. Basidioles 12–23 × 4.0–9.0 µm, clavate, fusoid. Cheilocystidia of two types: [1] (10–)15–20(–23) × (4.5–) 6.0–13 µm, broom cells of the Rotalis-type, broadly clavate, pyriform, thin-walled, often with brown walls in KOH; [2] 15–30 × 4.5–9.0 µm, lageniform or fusoid, rostrate, smooth or with scattered projections at upper part of a base,

Fig. 1. *Marasmius crescentiae*.
Basidiocarps (Hongcheon, Nae-myeon, Sambong-ri, V. Antonín 08.26, BRNM 718666).

obtuse to subacute, thin-walled. Pleurocystidia absent or rare, similar to cheilocystidia of the type 2, 17–35 × 4.5–9.0 µm, fusoid or lageniform, rostrate, thin-walled. Trama hyphae ± cylindrical, thin- to slightly thick-walled, hyaline, up to 12 µm wide. Pileipellis a hymeniderm composed of (8.0–)10–21 × 7.0–14(–17) µm, clavate, pyriform or (sub) vesiculose cells of the Rotalis-type, thin-walled at base, thin- to slightly thick-walled at apex; diverticula up to 1.5×0.75 µm, numerous; thick-walled parts brown in KOH. Pileocystidia (12–)15–25 (–30) × 4.0–8.0 µm, fusoid or lageniform, rostrate, thin- to slightly thick-walled (especially in central part), sometimes with projections in upper basal part; with chestnut brown wall in thick-walled parts. Stipitipellis a cutis of cylindrical, parallel, slightly thick-walled, diverticulate, up to 5.0 µm wide hyphae with brown walls in KOH. Caulocystidia absent. Clamp connections present in all tissues.

Chemical reactions — No part of basidiocarps amyloid or dextrinoid.

Ecology — On fallen leaves of *Acer, Quercus acutissima, Juglans,* and other broadleaved trees, dead plant stems.

Specimens examined — **REPUBLIC OF KOREA**, Hongcheon, Nae-myeon, Eulsudong valley, 37°41′11″N 128°29′35″E, alt. c. 670 m, 26 July 2007 leg. V. Antonín (07.131) and R. Ryoo (BRNM 714783); Deogyusan National Park, Cheon-yeon falls, 24 Aug. 2007 leg. R. Ryoo KG 164 (BRNM 714678); Hongcheon, Nae-myeon, Sambong-ri, 26 June 2008

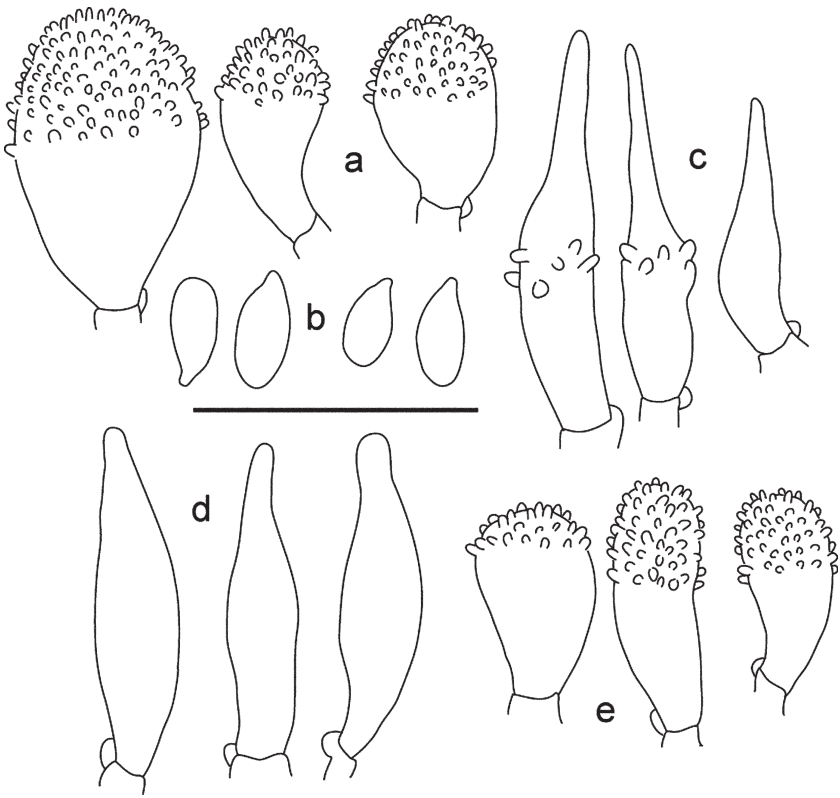

Fig. 2. *Marasmius crescentiae*.
a. Pileipellis cells, b. basidiospores, c. pileocystidia,
d. cheilocystidia (type 2) and pleurocystidia, e. cheilocystidia (type 1). Scale bar = 20 µm.

leg. V. Antonín (08.25, 08.26) and R. Ryoo (BRNM 718665, 718666); Wonju, Chiaksan National Park, between N.P. office and Guryongsa, 37°24′17″N 128°03′00″E, alt. 310–360 m, 19 July 2009 leg. V. Antonín (09.135) and R. Ryoo (BRNM 718790).

Remarks — The South Korean collections of *M. crescentiae* are characterized by small basidiocarps, a sulcate light brown to brownish orange pileus, rather large basidiospores, tetrasporic basidia, cheilocystidia of two types, absent or scattered pleurocystidia, present pileocystidia, absent caulocystidia, and present clamp connections. Although Singer (1976) observed smaller basidiospores (6.5 × 2.7 µm), Desjardin & Horak (1997) cited larger basidiospores (7.5–8.5 × 3.5–4.0 µm).

Very similar species are *M. micraster* Petch, with slightly larger basidiospores (Desjardin & Horak 1997: 9–11(–12) × (3.5–)4–5(–5.5) µm; Pegler 1986: 8.5–11 × 4.0–5.5 µm) and 18–30 µm long basidia (Singer 1976), and *M. exustus*

Berk. & M.A. Curtis, with smaller (6.5–8.0 × 4–5 μm) basidiospores (Desjardin & Horak 1997). Other species differ either by macroscopic characters (e.g., *M. corbariensis* (Roum.) Sacc.; Antonín & Noordeloos 2010) or by developed caulocystidia (e.g., *M. minutus* Peck; Antonín & Noordeloos 2010).

Three sequences obtained from collections VA 07.131, KG 164 and VA 09.135 (BRNM 714783, 714678 and 718790; Table 1) of *Marasmius crescentiae* showed a significant ITS rDNA similarity (Fig. 3). Among LSU sequences trimmed by 1167 nucleotide characters, the three sequences showed no more than five base substitutions with each other.

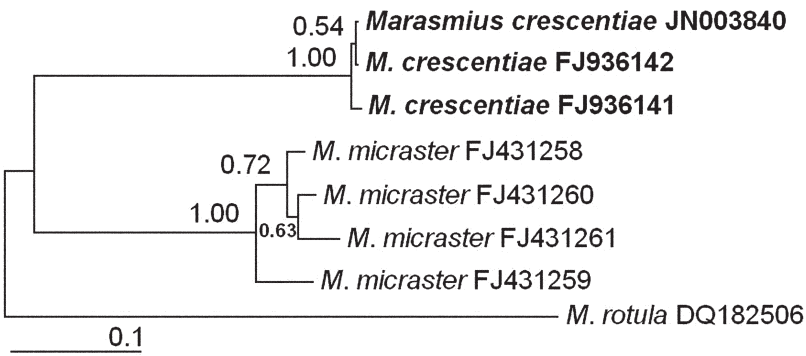

Fig. 3. Phylogenetic tree for *Marasmius* sect. *Hygrometrici* based on the ITS region (ITS1+5.8S rDNA+ITS2). Bayesian analysis running 1,000,000 generations represent mean branch lengths of a 50% majority-rule consensus tree calculated from 1000 trees revealed. Scale bar = number of nucleotide substitutions per site. **Bold face** = Species sequenced for this study.

"*Marasmius junipericola*" ad int. Fig. 4

Basidiocarps single. Pileus 1–1.5 mm broad, low convex to convex with obtusely applanate then slightly depressed centre, ± smooth when young, then slightly crenulate towards margin, covered with small brown granulose ± spiny scales, entirely brown (7E7) when young, later brown only at centre and whitish towards margin. Lamellae distant, L = 8–10 , l = 0–1, free or with small tooth, white, with concolorous, slightly pubescent edge. Stipe 4–8 mm long, filiform, insititious, entirely finely strigose-pubescent, dark brown (6–7E–F7), paler at apex.

Basidiospores (7.0–)8.0–9.5 × (4.2–)4.5–5.0 μm, average = 8.5 × 4.7 μm, E = 1.5–1.9, Q = 1.8, broadly ellipsoid, fusoid-ellipsoid, hyaline, thin-walled. Basidia 18–24 × 5.5–10 μm, 4-spored, clavate. Basidioles up to 22 × 5.0–9.0 μm, clavate, fusoid, subcylindrical. Cheilocystidia of two types, [1] 15–21 × 8.0–12 μm, broom cells of the Rotalis-type, broadly clavate, thin-walled; [2] 23–35 × 5.0–9.0 μm, lageniform or fusoid, rostrate, obtuse, thin-walled.

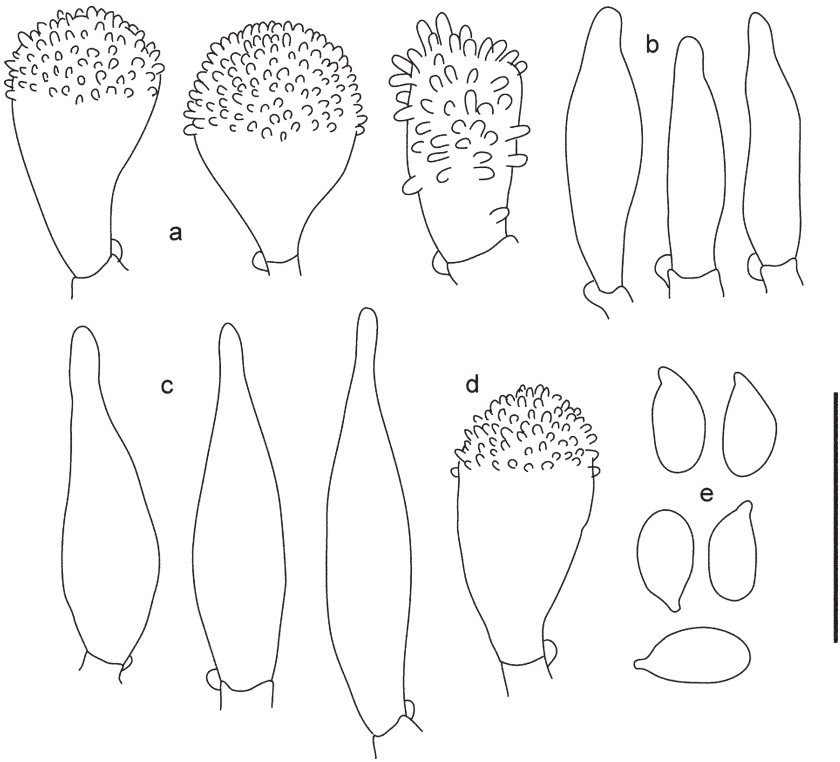

Fig. 4. "*Marasmius junipericola*".
a. Pileipellis cells, b. pileocystidia, c. cheilocystidia (type 2),
d. cheilocystidia (type 1), e. basidiospores. Scale bar = 20 µm.

Pleurocystidia rare, similar to cheilocystidia of type 2. Trama and context hyphae ± cylindrical, branched, thin- to slightly thick-walled, smooth or minutely incrusted, up to 8.0 µm wide. Pileipellis a hymeniderm composed of 16–28 × 9.0–16 µm, (broadly) clavate, vesiculose cells of the Rotalis-type, entirely thin-walled or with slightly thick-walled apex; mixed with scattered cells with larger diverticula or diverticulate hyphae. Pileocystidia 21–25 × 5.0–6.5 µm, ± fusoid, rostrate, thin-walled. Stipitipellis a cutis of cylindrical, parallel, distinctly thick-walled (walls up to 2.0 µm thick), mostly smooth, less frequently with scattered diverticula. Caulocystidia 20–40 × 3.0–6.0 µm, adpressed to erect, cylindrical, narrowly clavate, subfusoid, mostly slightly thick-walled. Clamp connections present in all tissues.

Chemical reactions — No part of basidiocarps amyloid or dextrinoid.

Ecology — On fallen needles of *Juniperus chinensis* var. *kaizuka*.

Specimen examined — **REPUBLIC OF KOREA**, Sobaeksan National Park, Sobaeksan Youth Hostel area, 16 July 2007 leg. J.G. Han (Antonín 07.59, BRNM 714677).

Remarks — "*Marasmius junipericola*" is similar to *M. crescentiae* but differs by the presence of well-developed caulocystidia. Although it represents a distinct taxon, the collection was too small (two minute basidiocarps) for a valid description of a new species. For similar taxa, see the discussion on *M. crescentiae*.

Acknowledgments

We gratefully acknowledge Jan Holec (National Museum, Prague, Czech Republic) and Michal Tomšovský (Mendel University, Brno, Czech Republic) for critically reviewing this manuscript. The collecting trip to the Republic of Korea and the studies of the collected material by the first author were supported by the Czech Science Foundation (No. 206/07/J003). The other authors were supported by the Korea Research Foundation Grant funded by the Korean Government (KRF-2006-F00001), and research grant by Korea Forest Institute (FP 0801-2010-01).

Literature cited

Antonín V, Noordeloos ME. 2010. A monograph of marasmioid and collybioid fungi in Europe. IHW-Verlag, Eching. 480 p.

Antonín V, Ryoo R, Shin HD. 2009. Marasmioid and gymnopoid fungi of the Republic of Korea. 1. Three interesting species of *Crinipellis* (*Basidiomycota, Marasmiaceae*). Mycotaxon 108: 429–440. http://dx.doi.org/10.5248/108.429

Antonín V, Ryoo R, Shin HD. 2010a. Marasmioid and gymnopoid fungi of the Republic of Korea. 2. *Marasmius* sect. *Globulares*. Persoonia 24: 49–59. http://dx.doi.org/10.3767/003158510X496107

Antonín V, Ryoo R, Shin HD. 2010b. Marasmioid and gymnopoid fungi of the Republic of Korea. 3. Two new taxa of *Marasmius* sect. *Sicci* with caulocystidia and/or setae. Mycotaxon 111: 369–377. http://dx.doi.org/10.5248/111.369

Antonín V, Ryoo R, Shin HD. 2010c. Two new marasmielloid fungi widely distributed in the Republic of Korea. Mycotaxon 112: 189–199. http://dx.doi.org/10.5248/112.189

Antonín V, Ryoo R, Shin HD. 2011. Marasmioid and gymnopoid fungi of the Republic of Korea. 4. *Marasmius* sect. *Sicci*. Mycol. Progress (in press). http://dx.doi.org/10.1007/s11557-011-0773-y

Desjardin DE, Horak E. 1997. *Marasmius* and *Gloiocephala* in the South Pacific Region: Papua New Guinea, New Caledonia, and New Zealand taxa. Part 1: Papua New Guinea and New Caledonia taxa, Part 2: New Zealand taxa. Bibl. Mycol. 168: 1–152.

Holmgren PK, Holmgren NH. 1998 (continuously updated). Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/.

Kornerup A, Wanscher JH. 1983. Methuen handbook of colour. 3rd edn. Methuen Co., London.

Pegler DN. 1986. Agaric flora of Sri Lanka. Kew Bull., Addit. Ser. 12: 1–519.

Ronquist F, Huelsenbeck JP. 2003. MRBAYES 3: Bayesian phylogenetic inference under mixed molds. Bioinformatics 19: 1572–1574. http://dx.doi.org/10.1093/bioinformatics/btg180

Singer R. 1976. *Marasmieae* (*Basidiomycetes – Tricholomataceae*). Fl. Neotrop. 17: 1–348.